fully ſatisfied to what degree of exactneſs it can be made to anſwer the end propoſed, I am,

Gentlemen,

June 4, 1752.

Your moſt obedient

humble ſervant,

J. Ellicott.

LXXXII. *A Deſcription of a new* Tackle *or Combination of* Pullies, *by Mr.* J. Smeaton.

Read June 11, 1752.

THE axis *in peritrochio*, and the compound pulley, are the only mechanic powers, which can with convenience be applied to the moving large weights, when the height, to which they are intended to be raiſed, is conſiderable. The excellence of the former is, their working with little friction; that of the latter, in their being eaſy to be moved from place to place, and applied *extempore*, as occaſion requires.

The preſent methods of arranging pullies in their blocks may be reduced to two. The firſt conſiſts in placing them one by the ſide of another upon the ſame pin; the other in placing them directly under one another, upon ſeparate pins. But in each of theſe methods an inconvenience ariſes, if above 3 pullies are framed in one block. For, according to the firſt method, if above 3 pullies are placed by the ſide of one another, as the laſt line, by which the draught is is made (or, as it is commonly called, the fall of the tackle) muſt neceſſarily be upon the outſide pulley or ſhieve; the difference of their friction will give it ſo great a tendency to pull the block awry, that as much will be loſt by the rubbing of the ſhieves againſt the block, on account of its obliquity, as will be got by increaſing the number of lines.

The ſecond method is free from this objection; but, as the length of the two blocks, taken together, muſt be equal to the ſum of the diameters of the ſix pullies, beſides the ſpaces between for the ropes, and the neceſſary appendages of the framing, were there more than three pullies in each block, they would run out into ſuch an inconvenient length, as to deduct very conſiderably from the height, to which the weight might otherwiſe have been raiſed: ſo that, upon thoſe accounts, no very great purchaſe can be made by the common tackles of pullies alone.

In order therefore to increaſe its power, ſometimes a ſecond tackle is fixed upon the fall of the firſt; but here it is obvious, that whatever be the power of the ſecond tackle, the height to which the weight might otherwiſe have been raiſed by the firſt, will be leſs in the ſame proportion as the purchaſe is increaſed by the ſecond.

Again, very frequently the fall of the firſt tackle is applied to an axis *in peritrochio*, which increaſes the purchaſe very commodiouſly without the inconveniencies laſt-mention'd; but then the machine is render'd cumberſome, and, conſequently, leſs fit for a moveable apparatus.

All thoſe impediments I have avoided, by combining the two methods, above deſcribed, in one.

The

The pullies are here placed in each block in two tier; ſeveral being upon the ſame pin as in the firſt method, and every one having another under it, as in the ſecond; as alſo that, when the tackle is in uſe, the two tier, that are the remoteſt from one another, are ſo much larger in diameter than thoſe that are neareſt, as to allow the lines of the former to go over the lines of the latter without rubbing.

From this conſtruction ariſes a new method of new method of reeving the line upon the ſhieves: For here let the number of ſhieves be what it will, the fall of the tackle will always be upon the middle ſhieve, or on that next the middle, according as the number of pullies on each pin is odd or even.

To do this, the line is fixed to ſome convenient part of the upper block, and brought round the middle ſhieve of the larger tier of the under block, from thence round one of the ſame ſort next to the centre one of the upper block; and ſo on till the line comes to the outſide ſhieve, where the laſt line of the larger tier falls upon the firſt ſhieve of the ſmaller, and being reeved round thoſe, till it comes at the oppoſite ſide, the line from the laſt ſhieve of the ſmaller tier again riſes to the firſt of the larger, whence it is conducted round till it ends on the middle ſhieve of the upper block on the larger tier; as will appear more plain, by inſpection of the figure annexed.

In this method all the lines are clear of one another, and the blocks are kept parallel. The model which I have the honour to ſhew the Society, and from which I made the draught, is a compoſition of 20 ſhieves, five on each pin. With this model, which may eaſily be carried in the pocket, I have raiſed

raiſed 600 weight. But with a tackle of this ſort, properly executed in large, one man will eaſily raiſe a ton, and a greater number in proportion *.

I have tried ſeveral numbers of ſhieves as far as 36; but 20 ſeems to be the largeſt number, that will anſwer well in practice.

A very commodious tackle of 12 might be executed in wood, in the ſame manner that common blocks are made.

I ſhould not have troubled the Royal Society with an account of this contrivance, did it not ſeem promiſing of much utility, in a variety of purpoſes; particularly for merchants, ſeamen, builders, engineers, *&c.* I therefore intirely ſubmit it to the cenſure of that honourable body.

J. Smeaton.

P. S. In conſtructing a tackle of 20 for 3 tons, the larger tier of ſhieves ſhould not be leſs than 8 inches, the running line needs not be thicker than half an inch diameter, and the iron pins need not be ſo thick.

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* A large tackle of 20 was tried on board one of his Majeſty's ſhips; and by the help thereof, tho' it was with a new rope, one man raiſed one of the ſhip-guns and carriage, that together weighed 27 hundred-weight; there being a perſon, as uſual, to *hold on*, or prevent the rope from ſlipping back.

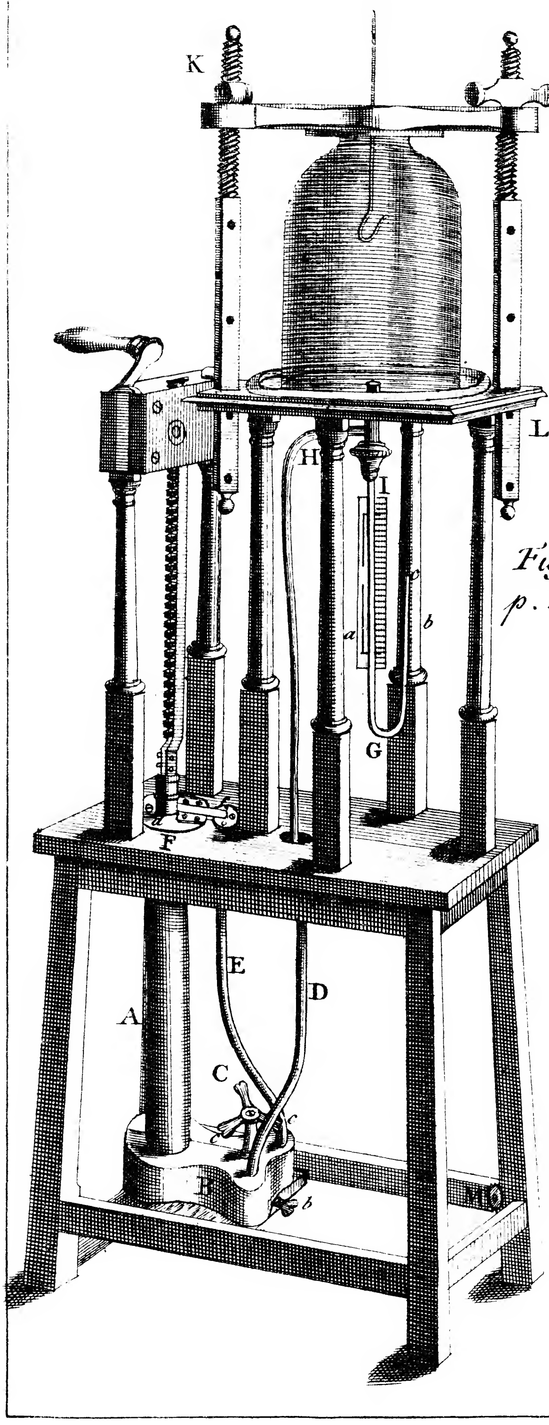


Fig. 1.
p. 424.

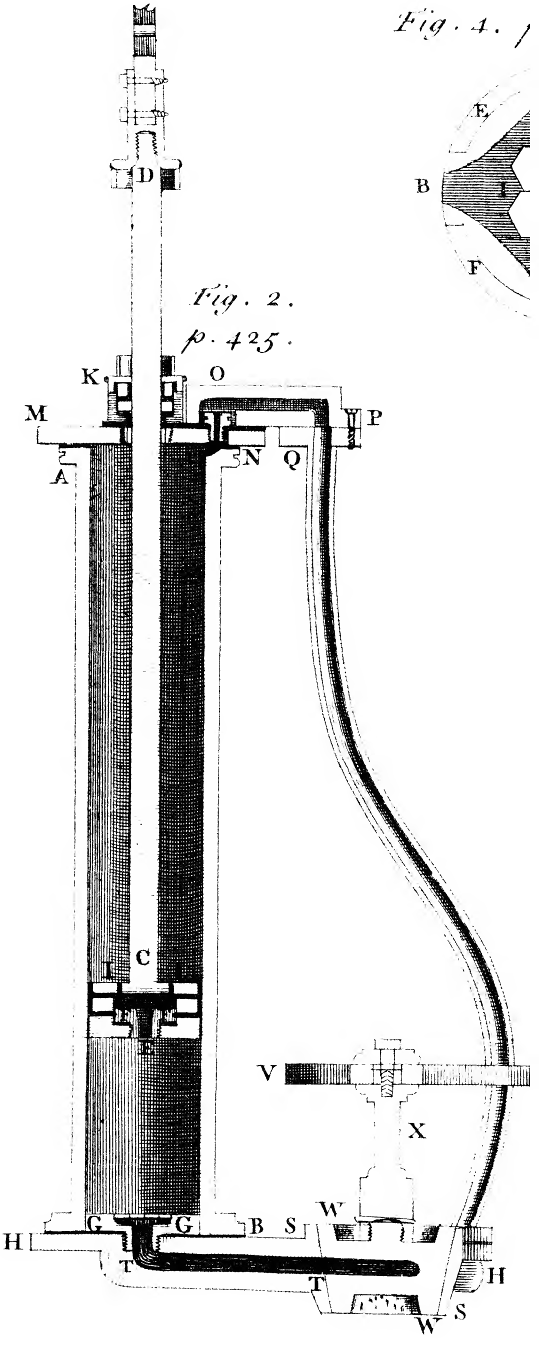


Fig. 2.
p. 425.

Fig. 4. p

Fig. 4. p. 427.

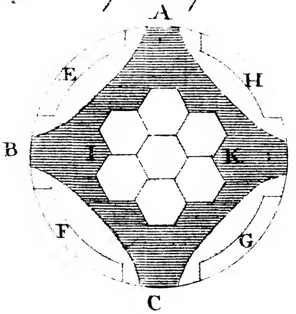


Fig. 6. p. 494.

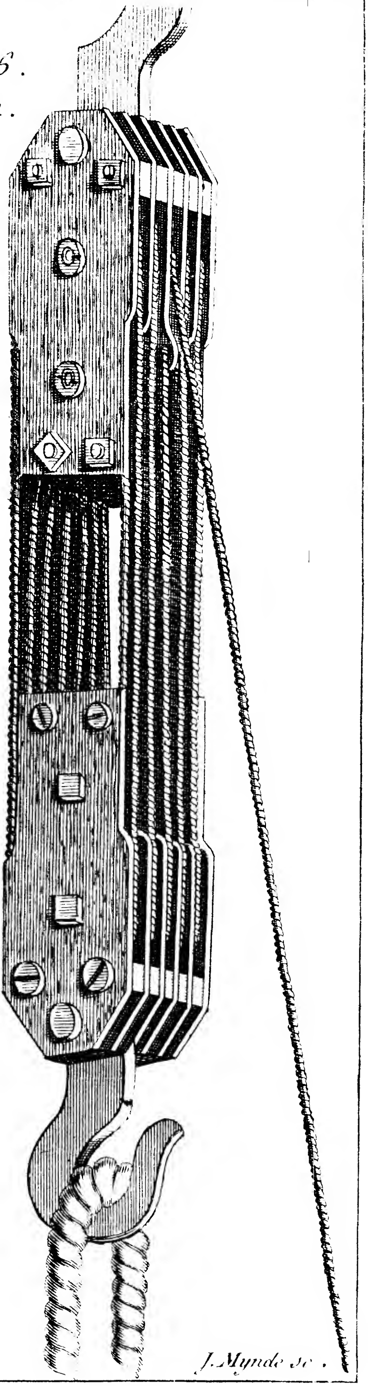


Fig. 5. p. 428.

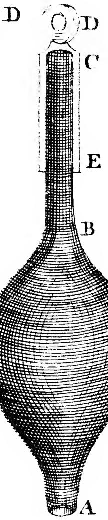


Fig. 2. p. 425.

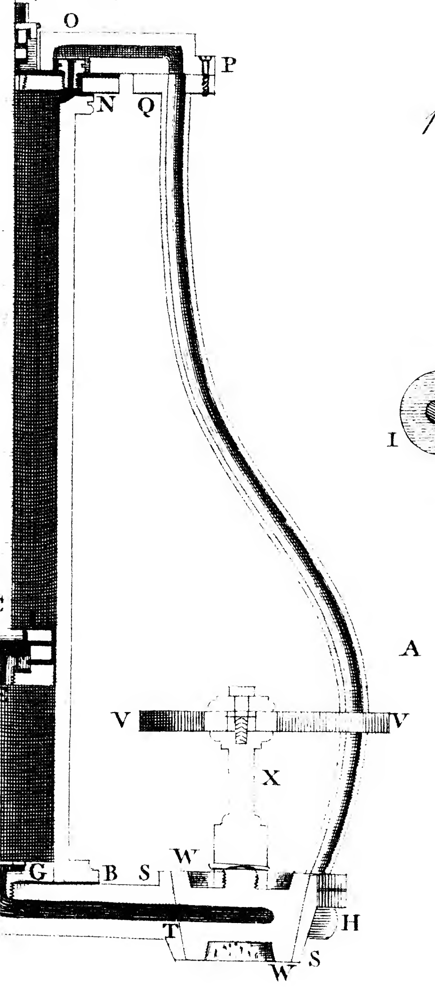
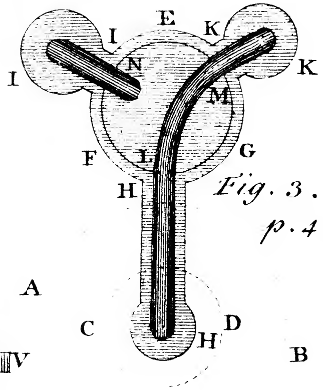
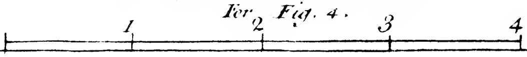


Fig. 3. p. 426.



A Scale of Inches.



J. Mynde sc.